TRANSPORTATION RESEARCH IN THE UNITED STATES
CHALLENGES AND OPPORTUNITIES

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MDOT Transportation Summit
December 3, 2003

I. Transportation Research has paid off. The U.S. transportation system, the envy of the world, is a product of more than just a willingness to make substantial infrastructure investments; it is also a product of continuous innovation driven by research. Examples:

A. Highway Safety—the fatality rate per mile driven has declined by an order of magnitude since the 1920s due to innovations in roadway design, vehicle design, enforcement, and training.

B. Highway Pavements—Pavements are subjected to traffic and loadings that were unimaginable at the time they were first constructed. The introduction of Superpave is one of the more recent examples of research-based design changes that have increased the durability and cost-effectiveness of road pavements.

C. Snow and Ice Control—Matching Road Weather Information Systems with an expanded portfolio of snow and ice treatment strategies, including anti-icing treatments, keeps roads usable and safe in storm conditions.

D. Public Transportation—Automated fare collection, low-floor buses and light rail vehicles, and special paratransit services are now commonplace; all were developed through research and testing.

E. Traffic Control—Beginning in the 1920s with Garrett Morgan, a series of traffic control devices of ever increasing complexity has been introduced. One illustration: A new traffic signal control system in Los Angeles reduced travel time by 18%, signal delays by 44%, fuel consumption by 13%, and air pollutant emissions by 14%.

F. Motor Vehicles—Design changes in motor vehicles have dramatically reduced air pollutant emissions since the early 1970s—up to 90%--and improved average fuel economy (60% between 1970 and 1993).

II. The need for research and innovation in transportation is as great today as it has ever been. Illustrations:

A. Changing values—As the United States became more affluent and public values shifted, new demands and expectations were placed on the transportation system (e.g., minimizing/mitigating environmental impacts; context-sensitive design). This process is ongoing and will inevitably force further changes in the transportation system.

B. Changing Demographics—For instance, a growing elderly population will require—probably will demand—a new set of transportation options and accommodations (about 20% over 65 by 2025, around 13% today).

C. Highway Safety—Despite our progress at reducing fatalities per mile traveled, highway transportation remains a major public health problem. Further progress will require new, more fundamental knowledge about crash causation and driver performance.

D. Economics—Deregulation and information technology working together synergistically spurred a revolution in logistics; transportation became part of the manufacturing process (e.g., just-in-time delivery). How will this be sustained in the face of mounting traffic congestion? What new intermodal capabilities are needed?

E. Reconstruction—Aging Interstates and other major arterials need reconstruction, but they must be reconstructed while service is maintained. This calls for a new "get in, get out, stay out" approach that uses new construction and traffic management techniques, new materials and designs, and new institutional and contractual relationships.

III. Research and other innovation-related activities themselves are challenged in the United States. Our progress is all the more remarkable given the barriers to innovation.

A. Decentralized system—Our transportation system is a public-private enterprise is incredibly decentralized—about 35,000 governmental units own highways; we have roughly 6000 public transit systems; tens of thousands of provide companies provide materials, construction and other services. All this poses an enormous technology transfer and organizational challenge.

B. Procurement—Low bid procurement procedures and prescriptive method specifications provide few incentives for the private sector to deliver innovative products.

C. Risk Adverse Culture—For many public agencies the risk of failure when a new product or technique is introduced often outweighs the potential rewards of success.

D. Low-Tech Image—Transportation infrastructure has a decidedly low-tech image leading some to believe we have nothing left to learn. Basic construction materials may trace their origins to antiquity, but our knowledge of their performance is still surprisingly limited. The stakes are large—state DOTs spend about $10 billion each year on hot-mix asphalt alone.

E. Research Funding—Funding for research is not proportionate to the scale of the transportation enterprise or the challenges and opportunities we face. For instance, highway research and technology spending amounts to about 0.6% of total highway spending by public agencies. Low-tech private sector industries typically spend 1-3%; high-tech industries upwards of 10%.

IV. Like the transportation system itself, transportation research in the United States is decentralized and depends on many component parts to function effectively.

A. The role of the federal government is critical. Examples:

--State Planning and Research (SP&R) program facilitates and encourages research by state DOTs.

--The federally funded Transit Cooperative Research Program (TCRP) provides local and regional transit agencies with a means to address common problems through applied research. A similar program for airports is now pending before Congress.

--The federal government is also best positioned, really uniquely positioned, to sponsor long-term research with higher risks and potentially higher payoffs. Often it is especially well positioned to facilitate technology transfer activities across states, regions, and modes.

--For highway research, a recent TRB expert committee recommended that the federal program would be more effective if it gave greater focus to fundamental, long-term research and

gaps not being addressed elsewhere; involved other stakeholders to a greater degree in setting its research agenda; and relied on competition and merit review more frequently to select research institutions.

B. States also play an important role in transportation research.

--Although state DOT research is traditionally highway focused, some states are expanding the scope of their research to embrace other modes for which they have growing interests and responsibilities.

--As operating agencies, state DOTs can directly benefit from innovations and are in a particularly good position to manage highly applied research and other activities that support the introduction of new methods (e.g., testing, training, demonstrations, and diagnostics).

--Through cooperative research such as NCHRP and pooled fund arrangements, individual states can leverage their research resources to address problems of regional or national interest.

--States in partnership with the federal government often take responsibility for transferring technology to local agencies, which usually have no research or technology transfer programs of their own.

C. Universities contribute in two ways—by conducting research and attracting and preparing students for careers in transportation.

D. Finally, given the decentralized character of the U.S. transportation system, multiple mechanisms are needed to link researchers and practitioners, avoid inappropriate duplication in research, and promote technology transfer.

--TRB, AASHTO, APTA, and ITS America committees and annual meetings.

--Publications, web pages, and searchable data bases (e.g. TRIS)

--Training (e.g. National Highway Institute, National Transit Institute)